Geological Survey of Japan Cruise Report No. 19, p. 103–108, 1984

XIII. CONTINUOUS SEISMIC REFLECTION PROFILING SURVEY OF KASHIMA NO. 1 SEAMOUNT AND ADJACENT AREA

Yukinobu Okamura, Ko-ichi Nakamura, Manabu Tanahashi and Yoshihisa Okuda

Kashima No. 1 seamount and adjacent areas were surveyed by the continuous seismic reflection method. Equipment and its conditions during the survey are shown in Table XIII–1.

The Kashima No. 1 seamount is located 150 km east off Choshi, east Kanto. It rises from the outer trench slope with 3,500 m relief, and its western edge contacts with the inner trench slope where the trench is interrupted by the seamount. In the northern side of the seamount, the trench is called the Japan Trench and southern side is called the Izu-Ogasawara Trench. Detailed bathymetric survey had been carried out by the Hydrographic Department, Maritime Safety Agency, which clarified anomalous bathymetric geomorphology of the Kashima No. 1 seamount. MOGI and NISHIZAWA (1980) concluded that the Kashima No. 1 seamount has been halved by NE-SW trending normal fault and that the western half of the seamount has subsided about 1,500 m relative to the eastern half of the seamount. In this paper we describe mainly reflection character on the seismic profiles.

Results

The survey area is divided into four provinces by the bathymetric geomorphology and the reflection character on the seismic profiles; inner trench slope, trench, seamount, and outer trench slope.

Inner Trench Slope The inner trench slope stands sharply up from the trench about 4,000

Table XIII–1 Equipment and operating conditions

Air Gun	Bolt Par Air Gun Model 1900C
volume of air chamber	150 in^3 (4920 cm^3)
pressure	1500 psi (105 kg/cm^2)
shot interval	13 sec
Hydrophone	hydrostreamer with Teledyne T-1 × 98 elements towed 150 m behind the ship
Band-pass filter	50–160 Hz
Ship speed	10 kt
Recorder	Raytheon LSR 1811

to 5,000 m. It is composed of hyperbolic sea-bottom reflectors and no systematic subbottom reflectors. The sea-bottom reflectors are weak as compared with those in oceanic side of the trench. The reflection characters suggest that the inner trench slope is composed mainly of highly deformed and semi-consolidated sedimentary rocks.

Trench The trench runs in NE-SW to NNE-SSW directions and interrupted in the just western side of the Kashima No. 1 seamount where the seamount directly contacts with the inner trench slope. The boundary between the seamount and the inner trench slope is marked by the V-shaped depression, which continues northward to the Japan Trench and southward to the Izu-Ogasawara Trench.

In the southern side of the seamount, the trench floor underlain by sediments deepens from 7,000 m to 9,000 m toward the southwest. The sediments in the trench is well stratified in comparision with those on the outer trench slope, suggesting that the sediments are terrigenous origin. The thickness of the sediments is unknown because the base cannot be detected by the seismic profiling system.

At the just north of the seamount, a part of the trench at water depths more than 7,800 m is filled by sediments. It is unclear if the sediments are terrigenous or not. In the northwest of the Katori seamout which is located northeast of the Kashima No. 1 seamount, no sediments fill in the trench, and the foot of the seamount directly contacts with the inner trench slope.

The intensity of the reflection from the sea-bottom changes at the trench, *i.e.* the reflection on the inner trench slope is poorer than that in the oceanic side of the trench (Fig. XIII–1 to 3). This indicates that sea-bottom materials are different between the both sides of the trench.

Outer Trench Slope The outer trench slope is underlain by the upper transparent layer and the lower opaque one (Fig. XIII–4). The upper transparent layer about 0.2 to 0.45 sec (two-way travel time) thick has occasionally weak subbottom reflectors and often becomes well stratified around the seamount. Normal faults cut the outer slope. The strikes of the faults are parallel or sub-parallel to the direction of trench, and the number and vertical displacement values of the faults increase toward the trench from the ocean side (Fig. XIII–1).

Seamount The Kashima No. 1 seamount is divided into the western part and the eastern part by the NNE-SSW trending scarp of which western side is thrown down about 1,500 m.

The flat top of the eastern part of the seamount about 3,500 m to 4,000 m deep is nearly half circular shaped whose western half is cut off by the NNE-SSW trending scarp (Fig. XIII–1). The length of the flat top is 18 km in the NE-SW direction and the width is 8 km. On the flat top, two grabens whose width and depth are less than 1.5 km and 100 to 150 m respectively run in the NE-SW direction. The scarp bounding the western side of the flat top is considered to have been formed by normal faulting. The steep scarp continues to the northward and southwestward cutting the seamount slope and merges into the trench. Several canyons cut the seamount slope. Some of them run radially from the top but others arrange sub-parallel to the trend of the scarp. Most of the later canyons continue to the

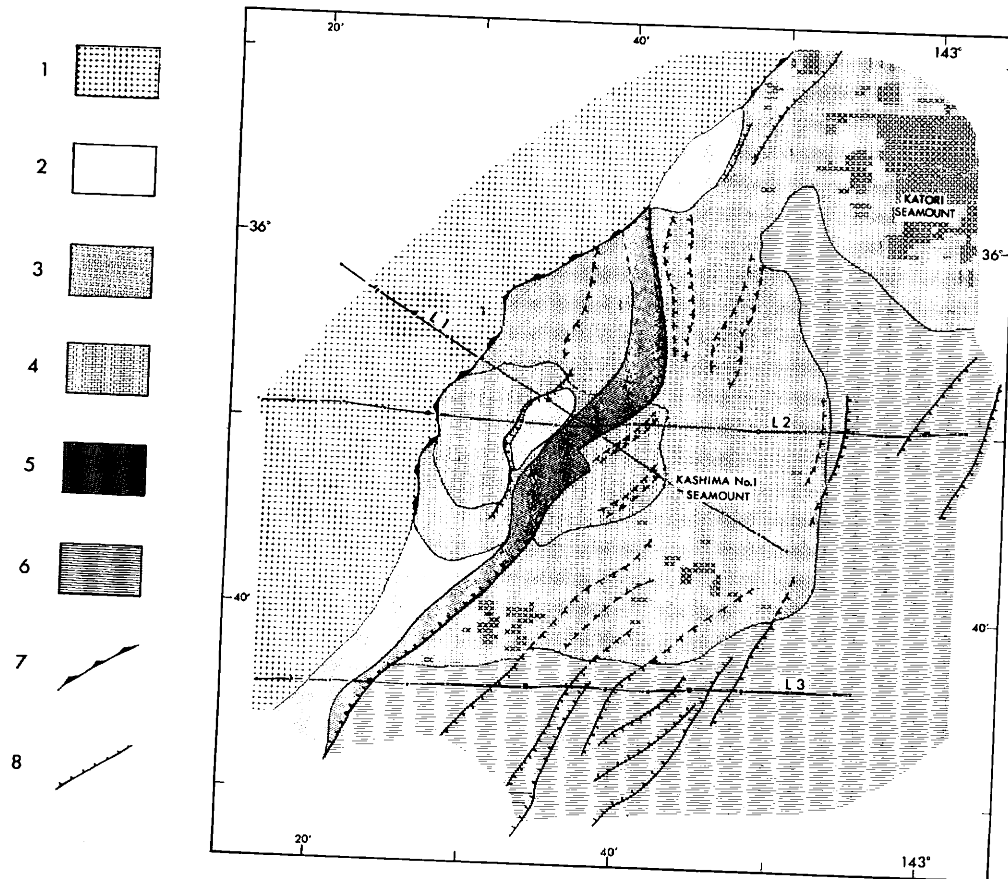

Fig. XIII-1 Tectonic map of the Kashima No. 1 seamount and adjacent area: 1) inner trench slope; 2) non- or slightly deformed well stratified sediments; 3) slope of seamount; 4) flat top of seamount; 5) scarp bounding the Kashima No. 1 seamount into the western part and the eastern part; 6) trench outer slope covered by oceanic sediments; 7) boundary of highly reflective oceanic part and poorly reflective inner trench slope; 8) normal fault (prospected).

normal faults cutting the outer trench slope. This suggests that most of the canyons cutting the seamount slope are fault origin.

The top of the western part of the seamount about 5100 to 5,400 m deep is flat and half circular shaped, and the length and the width of the top are 17 km and 11 km respectively. The flat top is smooth in comparison with the top of the eastern half and dips to the west about 3 degree (Fig. XIII-3 and 4). Subbottom reflectors parallel to the flat top occur through 0.6 sec below the seabottom, which suggests that the top of the seamount is composed mainly of thick limestone. At the eastern edge of the flat top, a graben whose width ranges from 1 to 3 km runs parallel to the trend of the scarp. Most parts of the graben on the flat top is covered by non-deformed sediments less than 0.07 sec thick. The graben continues to the north and the southwest on the slope of the western half seamount and merges into the trench.

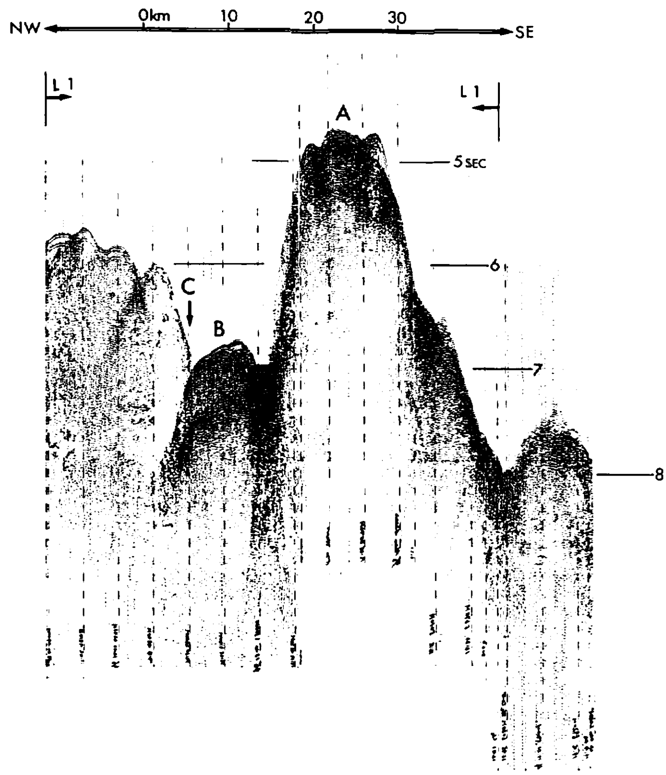

Fig. XIII–2 to 4 Seismic profiles along Lines L1, L2, L3 shown in Figure XIII–1. A) Flat top of the eastern part of the Kashima No. 1 seamount, B) Flat top of the western part of the Kashima No. 1 seamount, C) Trench.

Conclusion

Seismic reflection profiling survey shows many normal faults cutting the Kashima No. 1 seamount and adjacent outer trench slope. These faults are sub-parallel to the trench. The scarp deviding Kashima No. 1 seamount into the western part and the eastern part is considered to be formed by the one of the largest normal faults. This indicates that a tensional stress field normal to the trench is widely distributed at the ocean side of the trench.

Reference Cited

MOGI, A. and K. NISHIZAWA (1980) Breakdown of a seamount on the slope of the Japan trench, *Proc. Japan Acad.*, vol. 56, Ser. B, p. 257–259.

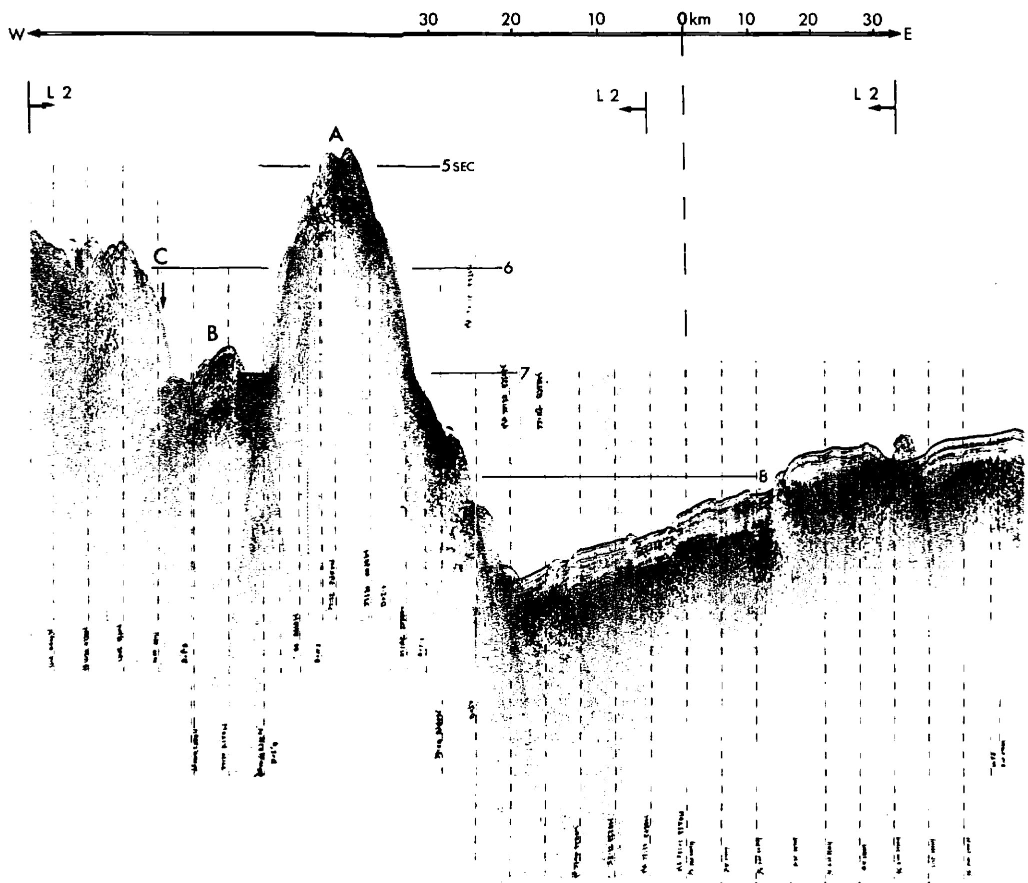

Fig. 3.

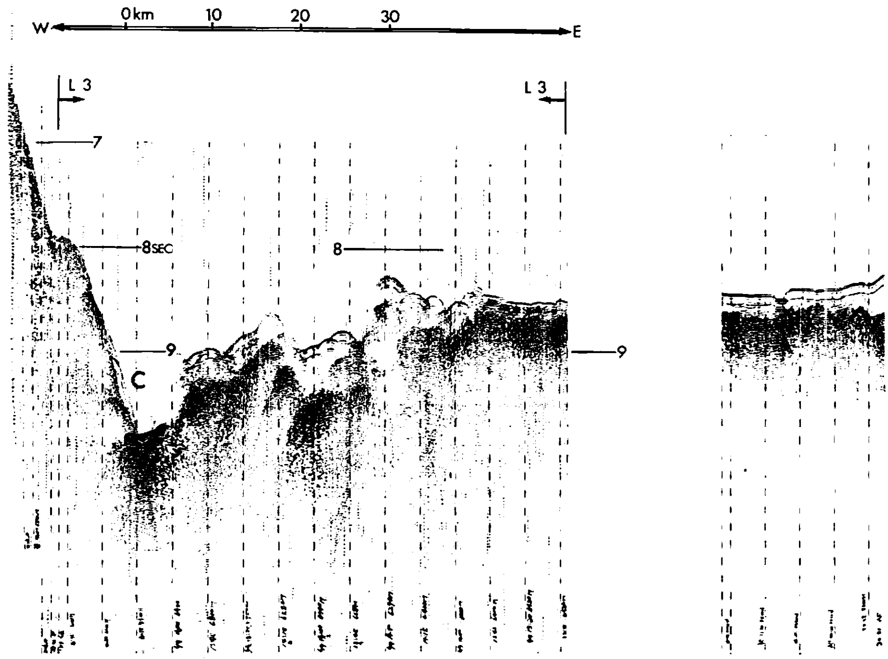

Fig. 4.